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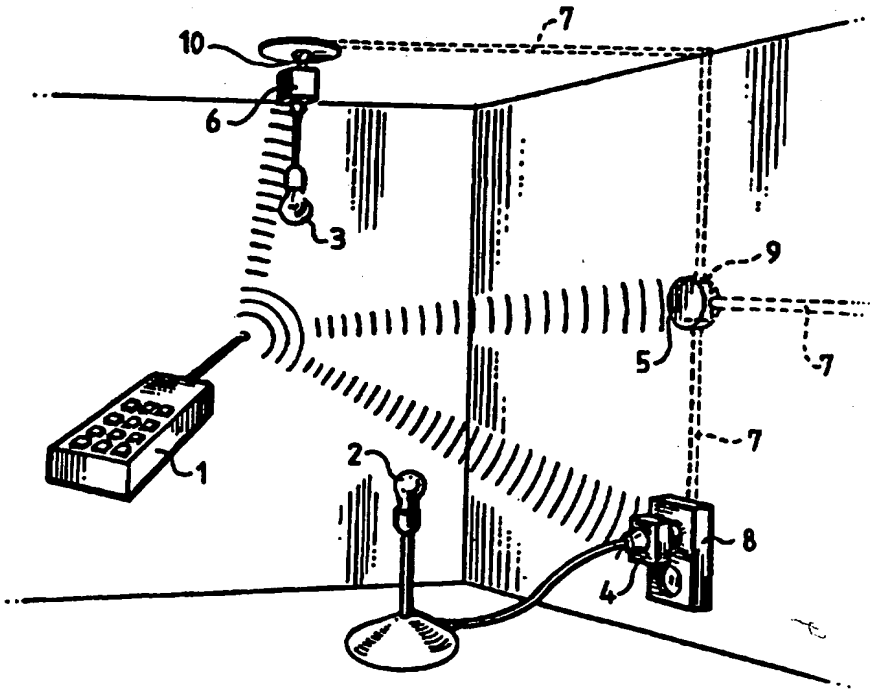
(57) Abstract

This invention relates to technique for remote control of the current supply to electric equipment. Particularly the invention is suited for electrical equipment connected to the part of the electrical power distribution network present in households, offices, and industries, wherein an operator, by means of manipulating a transmitter, which transmits a signal to a receiver situated at a distance, is able to control, by means of a regulator connected to the receiver, the current supply to the electrical equipment. A unique identity code is assigned before hand to each receiver, said identity code including a larger number of characters, and the receiver is equipped with means for secure reception of the signals transmitted from the transmitter containing such an identity code, so that the electrical equipment may be controlled without errors.



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A METHOD, A SYSTEM AND DEVICES FOR REMOTE CONTROL OF ELECTRICAL EQUIPMENT

TECHNICAL FIELD

This invention relates to technology for cordless remote control of the power supply to electrical equipment. Particularly, the invention is suited for electrical equipment connected to the part of the electrical power distribution network present in households, offices, and industry, wherein an operator, through manipulating a transmitter which transmits a signal to receiver a distance away, by means of a regulator connected to the receiver, controls the power supply to the electrical equipment. Alternatively the manipulation of the transmitter may be carried out by some electrical device without the presence of an operator.

PRIOR ART

US A 4 355 309 discloses a system for remote control of electrical equipment, including a receiver/switch unit provided in an electrical circuit connected to the electrical equipment, and at least one remote control unit for transmitting radio signals to be received by the receiver/switch unit, wherein each receiver/switch unit includes a receiver means with a separate antenna connected thereto for receiving radio signals transmitted from the remote control unit, an address setting means, and a switch means for switching said electrical circuit on or off. In the system disclosed therein the remote control unit can be activated to send the radio signals in the form of a digitally coded address which is checked in the receiver/switch unit with respect to correspondence with an address (identity code) set on the address setting means. When such a correspondence is at hand the switch means is controlled to switch the current in said electrical circuit on or off.

Drawbacks in the system according to US A 4 355 309 is the risk of unintentional manipulating, for example when nearby

receiver/switch units are assigned the same address, and an unnecessarily complicated design.

The above mentioned document is hereby incorporated by reference.

SUMMARY OF THE INVENTION

An object of the invention is, in a method and a system according to the introductory portion of the independent claims, respectively, to overcome the above mentioned drawbacks of the prior art and to achieve a system that, in combination, eliminates risk for identity code collision, provides secure reception and detection of received signals, permits large variations in distance between the remote control unit and the receiving unit, as low sensitivity to signal obstacles between the remote control unit and the receiver unit and to a signal level transmitted from the remote control unit, and has an uncomplicated construction.

Another object of the invention is to attain secure reception and detection of information, which is transmitted from the remote control unit to the receiver/regulator unit, when said information includes also an instruction in the signal block. This instruction may be selected from a group of a plurality of predetermined instructions, which specify different ways in the receiver/regulator unit to regulate the current (the power) in the electrical circuit, in which the receiver/regulator unit is connected. Due to such an ability to send a plurality of different instructions the current in the electrical circuit may be regulated in more ways than only on and off switching. For example different dimmer functions may be attained. A selection of possible functions will be evident from the description below of a preferred embodiment of the invention.

Yet another object of the invention is to provide a method which detects signals with high security, in particular digital signals, that have preferably a large information content and

that have non-ideal characteristics due to for example disturbances or distortion.

These objects are attained according to the invention in such a method and such a system through the characteristics in the characterizing portion of the respective independent claims. The invention is particularly useful when the electromagnetic signals transmitted from the remote control unit contain at least one digital signal component, which includes said information. The signals may include steps as well as pulses, and may, for transmission between the remote control unit and the receiver/regulator unit, be mixed with signals with other characteristics, for example a radio frequency carrier wave.

In order to eliminate the risk for collision or unintentional control of receiver/regulator units through correspondence between their identity codes, the invention uses such a large number of different identity codes, thus consisting of so many characters, that collision is impossible or at least the risk therefore is statistically insignificant.

In the past it has been difficult, particularly when the signalling has been based on repetitive transmissions, to handle such a large number of identity codes that is required in order to allow, also within a small area, a very large number of receiver/regulator units and/or several parallel systems functioning independently. There has been a great risk for the function to fail totally. In order to provide reliable control without disturbing re-transmissions, when using a large number of codes, for example the method according to claim 2 is provided, which increases the security in reception and detection in the receiver/regulator units of the longer identity codes in the signals transmitted from the remote control unit. With such a secure reception of the information in the receiver/regulator unit it is also possible to use more complicated groups of instructions.

Due to this, the invention does not require the use of high output power in the signals transmitted from the remote control unit and/or high quality antennas in the receiver/regulator units, which would have given a complicated construction.

According to the invention each receiver/regulator unit is assigned a unique identity code. It is unique in the sense that no identity code assigned to one receiver/regulator unit is to constitute an identity code for any other receiver/regulator unit, in particular not within the range of the information-bearing signals transmitted from an arbitrary remote control unit. It is suitable already in the manufacturing of the receiver/regulator units to assign unique identity codes to these according to predetermined routines. It is then also an advantage if the receiver/regulator units are arranged so that their identity codes are unchangeable or substantially unchangeable.

It is also advantageous that the signalling between the remote control unit and the receiver/regulator unit is performed with radio frequency electromagnetic radiation. It involves advantages such as a long range, high deflection and penetration for the signal. For the sake of simplicity it is then also advantageous to use conductors in the electrical circuit as a receiver antenna for the receiving/regulator units. Such conductors give a satisfactory antenna function in combination with the employed detection method.

For remote control of a group of electric equipments, which are connected to different receiver/regulator units, it is possible according to a development of the invention, to assign, in addition to the identity code, to the receiver/regulator units a group code to be stored in these receiver/regulator units. For simplicity this could be given a form to correspond in a signalwise way to the identity code. Levels, frequency, and, suitably, length (number of bits) are then preferably equal in the respective signal. Accordingly it is possible to control simultaneously a group of electrical equipments, where

applicable, corresponding fully to the treatment of the identity code, by means of several receiver/regulator units included in said group. The group code is then preferably identical to the identity code in one of the receiver/regulator units serving in the group. Through this storing of groups in the receiver/regulator units the demands on the remote control units for storing codes are lowered, and they may be given a less complicated construction.

In addition to the amplification control performed at the reception of data, there is in the receiver/regulator unit preferably a continuously active regulation, independent of data being received or not. This regulation has a longer term function than the regulation performed at data reception, i.e., the time constants in the regulation algorithms are greater.

This continuous amplification regulation proceeds in that the receiver detects reception of other than correct data sequences. When no erroneous data have been received within a given time period the amplification is increased by a small step. This goes on, the amplification is increased, until erroneous data is beginning to be received. The amplification is now so high that noise and disturbances are beginning to be significant in the receiver. When the amount of erroneous data per time unit exceeds a predetermined limit, the amplification is decreased by a small step. This goes on until the amount of errors per time unit is smaller than the predetermined limit.

By varying continuously the amplification in this way the highest possible amplification for satisfactory data reception is always attained in every occasion.

Other advantageous further developments of the invention are mentioned in the other claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows an embodiment of a system according to the invention with a remote control unit and receiver/regulator units designed in different ways but being functionally essentially equal and being mounted in roof and wall outlets and a wall terminal box;
Fig. 2 shows a simplified block diagram of an embodiment of a receiver/regulator unit according to the invention with a receiver/voltage transforming means, a signal processing means, and a regulator means;
Fig. 3 shows a circuit diagram of the receiver/regulator means of fig. 2;
Fig. 4 A shows graphically an example of the digital signals, which are present in the signal processing means of fig. 2 and are to be sensed and filtered;
Fig. 4 B shows graphically, in a partial enlargement of fig. 4 A, an example of the sensing method according to the invention used in the signal processing means;
Fig. 5 shows graphically an example of digital information transmitted from the remote control unit to the receiver/regulator unit of fig. 1.

DESCRIPTION OF A PREFERRED EMBODIMENT

The system shown in fig. 1 comprises a remote control unit 1, with the aid of which the current to light bulbs 2, 3 or other electric equipment is regulated, for example, in a room in a building indicated in fig. 1, and receiver/regulator units 4, 5, 6 receiving control signals and regulating the current to the electric light in accordance with information in the received signals.

The receiver/regulator unit 4 is arranged within a housing and is electrically connected partly to a wall outlet 8 in the room, partly to an electric fitting for the light bulb 2. The receiver/regulator unit 6 is arranged within a housing between a ceiling outlet 10 in the room and a ceiling electric fitting

for the light bulb 3 and is electrically connected partly to the wall outlet 10, partly to the fitting for the light bulb 3. The receiver/regulator unit 5 is arranged within a wall terminal box 9 and is electrically connected via electrical cables 7 to a central unit (not shown) in the building, to the wall outlet 8, and to the ceiling outlet 10. The electrical cables 7 are preferably cables incorporated in a power network present in the building with for example a 230 volt voltage.

The remote control unit 1 is movable and provided with an antenna and with buttons to be manipulated by an operator who wishes to remotely control the light intensity of any of the light bulbs 2, 3. When the buttons of the remote control unit 1 are manipulated in one of a number of predetermined ways it transmits via the antenna digitally modulated radio signals. These signals have a high ability to propagate through the air as well as through fixed part of the buildings or movable objects therein.

In this embodiment it is utilized that the transmitted radio signals give rise to superimposed currents in the cables 7, which are in connection with the receiver/regulator units 4, 5, 6 directly or via an outlet 8, 10. The cables 7 are used as antennas for the receiver/regulator units 4, 5, 6.

The receiver/regulator unit 4, 5, 6 shown in block form in fig. 2 comprises a receiver/voltage transformer means 15 (which shall be described more closely below with references to fig. 3), a signal processing means 16, a regulator means 17, and a first and a second conductor to be connected to the 230 volt alternating current of the cable 7. The first conductor is also connected to the receiver/voltage transformer means 15 and the regulator means 17. The second conductor is also connected to the receiver/voltage regulator means 15, the signal processing means 16, and the regulator means 17. Moreover, the second conductor is to be connected to the electrical equipment, which is illustrated in fig. 1 by the light bulbs 2, 3.

The receiver/voltage transformer means 15 is further connected to the signal processing means 16 through a third, a fourth and a fifth conductor supplying the signal processing means 16 with 5 volt direct current, with signal ground (0 volt), and with a signal demodulated in the receiver/voltage transformer means 15 and containing information received from the remote control unit, respectively.

The signal processing means 16, which includes in itself a memory means, not shown, is further connected to the regulator means 17 through a sixth conductor supplying the regulator means 17 with a control signal derived from the information received from the remote control unit.

The regulator means 17, which may be a triac as a simple form, is further to be connected via a seventh conductor to the electrical equipment.

The cable 7, the first conductor, seventh conductor via the regulator means 17, the electrical equipment, the second conductor and, again, the cable 7 form a circuit, which constitutes part of an electrical circuit, which includes the electrical equipment. The current of this electrical circuit, and thus for example the light intensity of a light bulb, may hereby be regulated by means of the regulator means 17 of the receiver/regulator unit.

From the circuit diagram depicted in fig. 3 of the receiver/voltage transformer means 15 (fig. 2) it is evident for a person skilled in the art how to obtain, after suitable dimensioning of the included electrical components, obtain partly preparation for demodulation of the antenna signals received from the cable 7, partly voltage transformation from the 230 volt alternating current of the cable 7 into a 5 volt direct current for the signal processing means.

According to the circuit diagram the first and the second conductor (fig. 2) are connected on the respective sides of a

series connection of, in the following order, a diode 21, a resistor 22, a resistor 23, and a zener diode 24. The cathodes of the diode 21 and the zener diode 24 are turned in the direction of the resistor 22 and the resistor 23, respectively. The interconnected ends of the resistor 23 and the zener diode 24 are connected via an inductance 25 to one end of a capacitor 28, a capacitor 30, a capacitor 33, and a resistor 35, as well as to the third conductor (fig. 2), which supplies a 5 volt direct current. The interconnected ends of the resistor 22 and the resistor 23 are connected via a capacitor 26 to the second conductor (fig. 2), the one end of an inductance 27, a capacitor 29, and a capacitor 31. The other end of the inductance 27 is connected to the other end of the capacitor 28, the capacitor 30, and the capacitor 29 as well as to the one end of a resistor 34, a resistor 38, a capacitor 40, and a capacitor 41, as well as to the fourth conductor (fig. 2), which constitutes 0 volt signal ground. The other end of the capacitor 31 is connected via a resistor 32 to the base of a bipolar NPN transistor 37, and to the other ends of the resistor 33 and the resistor 34. The emitter of the transistor 37 is connected to the other ends of the resistor 38 and the capacitor 40. The collector of the transistor 37 is connected via a parallel connection of an inductance 36 and a capacitor 39 to the other ends of the resistor 35 and the capacitor 41, and gives a signal, which is prepared for demodulating and which includes the information received from the remote control unit 1 (fig. 1). Also the demodulation in the receiver/voltage transformer means is performed by means of circuits known per se. The demodulated signal is output therefrom to the fifth conductor (fig. 2).

For high reception performance of the receiver/voltage transformer means 15 (fig. 2) the signal ground in it may be formed as a ground plane for the cable 7 (fig. 1), which works as an antenna.

Fig. 4 A shows along a time axis 50 a graphical example of the appearance of the demodulated signal (on the fifth conductor of

fig. 2), which is obtained from the radio signals transmitted from the remote control unit, which radio signals have been modulated with the information in digital form. The digital demodulated signal includes sections 51 with a high voltage level (logical 1) and sections 52 with a low voltage level (logical 0). In such sections disturbance sections 53 may occur as a result of sources in the surroundings of the remote control unit and the receiver/regulator unit, for example switches that generate radio frequency signals. Distortion of various types may also in this content be regarded as disturbances of the demodulated signal.

The method for sensing and filtering, used in the signal processing means 16 (fig. 2), of the demodulated signal of fig. 4 A, will be apparent from the explanation below as well as from an enlarged section shown in fig. 4 B, which is marked on the demodulated signal of fig. 4 A, with a high voltage level and a number of sections 54, which deviate from this level as a result of disturbances. Dashed lines perpendicular to the time axis for the signal mark a number of sampling points, at which the signal processing means senses a bit of the digital signal. For example in the sampling points at 52 a logical 0 has been sensed and the sampling points 56 a logical 1. The table below shows, for the different sample points, which logical level have been sensed.

Sampling point	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Sensed logical level	1	0	0	1	1	1	0	1	0	1
Majority value	1	0	-1	0	1	2	1	2	1	2

A majority value is used in performing the filtering in the signal processing means according to a majority method known per se. Before the sensing of a bit, the majority value is zero, then it is added thereto one or minus one when sensing a high or a low logical level, respectively. If the majority value is positive after a completed sampling, as in the table above, this means that the logical level of the bit is interpreted as high by the signal processing means. If the end value

is negative the logical level of the bit is interpreted as low. If the end value is zero the quality of the reception is to be regarded as so poor that the information is ignored and no alteration of the current in the electrical circuit is performed by the receiver/regulator unit 4, 5, 6 (fig. 1). In spite of the signal in fig. 4 A and fig. 4 B having a high content of disturbances it may thus be detected through the majority method described above.

The final majority value of a sensed bit, which is after a sampling +10 or -10 in the ideal case, gives a picture of the quality of the reception. The closer the value is to zero the lower the quality of the reception. The majority value is used by the signal processing means for regulating the amplification of the digital signal before sensing. This amplification preferably takes place in a amplification stage included in the signal processing means (fig. 2) for every received signal block (see closer description below with references to fig. 5), including predetermined number of bits, the signal processing means forms one mean value for all high bits and one mean value for all low bits. By comparing the absolute values of the two mean values the signal processing means is able to determine whether the amplification of the demodulated signal should be maintained, increased, or decreased.

For example, if the mean value of the high bits are 9 and the mean value of the low bits are -3 it is assumed that the amplification is too high, since the high level (carrier wave on the input) is detected close to perfect while the low level (no carrier wave on the input) is strongly disturbed. In this case the signal processing means decreases the amplification of the demodulated signal and thereby increases the level which the disturbances much have in order to be significant. In a corresponding way the amplification is increased if, for example, the mean value of the high bits is 3 and the mean value is 3 and the mean value of the low bits is -10.

Software algorithms in the signal processing means, which control the amplification, aim at obtaining equally great absolute values of the mean values for high level and low level. In this way the amplification is automatically regulated to a suitable level for secure reception. Another, more general, way to express the condition for this amplification regulation is that regulation takes place for better (logical) correspondence in subsequent reception between filtered and non-filtered information in the receiver/regulator unit.

The example shown in fig. 5 of the bit format of the modulated signal for the radio signals, transmitted in signal blocks from the remote control unit, includes four separate parts: a start code 60, an ID code (identity code) 61, a command code (instruction) 62, and a check sum (control information) 63.

Every single block starts with a predetermined start code which has the length of four bits. This code is interpreted and validity controlled by the signal processing means and is used for synchronizing the subsequent sensing. After the start code a 32 bit ID code follows, which indicates which receiver/regulator unit that the information in the signal block is intended for. After the ID code the command code of 8 bits follows. The command code indicates how the receiver/control unit should change the current in the regulated electrical circuit, for example, increasing/decreasing the mean value current to the connected lighting. Finally a check sum of 8 bits follows.

The information transfer takes place as indicated above by the signal transmitted from the remote control unit, for example at 433,92 MHz, being modulated in two levels: full signal and no signal. Full signal corresponds to high logical level (1) and no signal corresponds to low logical level (0).

When the receiver unit has received, sensed, and filtered a complete signal block of 52 bits the signal processing means performs checking of the signal block. If any one of the checks below indicates that the signal block is erroneous or not

intended for this receiver/regulator unit, the reception is ended immediately, no command is performed, and reception of a new signal block is enabled.

First it is checked whether the pattern of the start code is correct. Subsequently the signal processing means checks if the ID code corresponds to the ID code stored in the internal memory means in the receiver/regulator unit. If that is the case, it is checked whether the command given by the command code found among a predetermined set of commands stored in the memory means. If that is the case the check sum is finally checked. If the checks show that the signal block is correct and is intended for this receiver/regulator unit the command will be performed. This is done by the signal processing means, if indicated by the command, changes its control signal (via the sixth conductor in fig. 2) to the regulator means 17 (fig. 2).

A closer description of the information included in the respective part of a transmitted signal block is given below.

The start code always initiates a single block. The start code has a length of four bits and should always have the binary value 1001, decimally 9. If the start code does not have the value 9 the signal block is interpreted as erroneous and should be neglected.

The ID code is the fixed "address" incorporated in the signal block for the present receiver/regulator unit 4, 5, 6. The ID code has a length of 32 bits. The receiver/regulator unit compares the received ID code with its own preprogrammed ID code stored in the memory means.

If the ID codes correspond the signal block is intended for the present receiver/regulator unit. If the ID codes do not correspond the contents of the signal block is ignored. The description given here for the ID code is applicable in principle also

for a group code in case such a code is used in the receiver/regulator unit.

The command code has a length of 8 bits and includes information about which command should be performed by the receiver/regulator unit. The receiver/regulator unit compares the received command with a table stored in the memory means containing all of the commands that the receiver/regulator unit is able to perform. If the command is not present in the table no action is taken and the signal block is neglected.

A detailed description follows below of all the commands used in this embodiment. A complete command is always transferred in one signal block. This is necessary to avoid problems with the information transformation in environments with a lot of disturbances.

PON The command indicates that the receiver/regulator unit shall switch on the current to the controlled 230 volt equipment at the level that the current had before it was switched off. That value is stored in the memory means. If the current is already switched on the receiver/regulator unit does not perform anything. The command does not end PAUINC or PAUDEC commands possibly going on.

POFF The command indicates that the receiver/regulator unit should switch off the current to the controlled 230 volt equipment. If the current is already switched off the receiver/regulator unit does not perform anything. The command ends immediately all PAUINC or PAUDEC commands possibly going on.

PMAX The command indicates that the receiver/regulator unit should switch on the current to the controlled 230 volt equipment at maximum level. If the current is already switched on the set current is changed to maximum level. The command ends immediately all PAUINC or PAUDEC commands possibly going on.

PMIN The command indicates that the receiver/regulator unit should switch on the current to the controlled 230 volt equipment at minimum level. If the current is already switched on the set current is changed to minimum level. The command ends immediately all PAUINC or PAUDEC commands possibly going on.

PINC The command indicates that the receiver/regulator unit should increase the current to the controlled 230 volt equipment with a number of steps indicated by the command. The total number of regulating steps is 256. If the current is switched of when the PINC command is received the current is increased from minimum current level with the number of steps indicated in the PINC command. If the current reaches maximum level through the increase in the PINC command the current stops at maximum level after the command has been carried out. If the current was already at maximum level before the PINC command nothing is changed by the receiver/regulator unit. The commands ends immediately PAUINC or PAUDEC commands possibly going on.

PDEC The command indicates that the receiver/regulator unit should decrease the current to the controlled 230 volt equipment by a number of steps indicated by the command. The total number of regulation steps is 256. If the current is switched off when the PDEC command is received nothing is changed by the receiver/regulator unit. If the current reaches minimum level through the decrease in the PDEC command the current stops at minimum level after the command has been carried out. If the current was already at minimum level before the PDEC command the current is switched off. The command ends immediately PAUINC or PAUDEC commands possibly going on.

PAUINC The command indicates that the receiver/regulator unit should begin to increase automatically at a rate indicated by the command, the current to the controlled 230 volt equipment. When the current has reached maximum level the increase stops and the command is

completed. The command may also be stopped by the STOPAU command. If the current was already at maximum level before the command nothing is performed by the receiver/regulator unit. If the current is switched off when the PAUINC command is received the current is increased from minimum current level.

PAUDEC The command indicates that the receiver/regulator unit should begin to decrease automatically, at a rate indicated by the command, the current to the controlled 230 volt equipment. When the current has reached minimum level the current is switched off and the command is completed. The command may also be stopped by the STOPAU command. If the current was already switched off before the command nothing is performed by the receiver/regulator unit.

STOPAU The command indicates that the receiver/regulator unit should immediately end a PAUINC or a PAUDEC command going on. The automatic current change is ended immediately and the present current level is maintained. If no PAUINC or PAUDEC command is active when the STOPAU command is received, the receiver/regulator unit does not perform anything.

STOPRE1 The command indicates that the receiver/regulator unit should store in the memory the present current level as a preset current level 1. If the current to the controlled 230 volt equipment is turned off the current level 1 is stored as switched off. The command does not effect PAUINC or PAUDEC commands possibly going on.

STOPRE2 Same as above, but stores preset current level 2.

STOPRE3 Same as above, but stores preset current level 3.

STOPRE4 Same as above, but stores preset current level 4.

STOPRE5 Same as above, but stores preset current level 5.

RCLPRE1 The command indicates that the receiver/regulator unit should set the current to the controlled 230 volt equipment to the level which has been stored earlier in the memory means as current level 1. If no level has been stored earlier the current is set at maximum

level, which is the factory set value. The command ends immediately PAUINC or PAUDEC commands possibly going on.

RCLPRE2 Same as above, but sets the current to preset current level 2.

RCLPRE3 Same as above, but sets the current to preset current level 3.

RCLPRE4 Same as above, but sets the current to preset current level 4.

RCLPRE5 Same as above, but sets the current to preset current level 5.

The check sum (control information) always ends a signal block. The check sum has the length of 8 bits and is the sum of the five preceding bytes (40 bits) of the signal block, the four ID code bytes and the command code byte. The check sum is calculated by adding these bytes and masking some values over the byte limit, 256. The C code line below illustrates how the check sum is calculated.

```
Ckeck sum = (ID code[0] + ID code[1] + ID code[2]  + ID code[3]
+ Command code) % 256;
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The remote control unit transmits information with a check sum according to the above. The receiver/regulator unit calculates the check sum for the received information according to the above and then compares the result with the received check sum. If the values do not correspond the contents of the signal block is regarded as erroneous and no command is performed. If the values are equal the command which is indicated by the command code of the signal block is performed.

Naturally a variety of engineering developments of the invention described herein are possible without departing from the scope of the invention. For example, the remote control unit may be designed as or may be manipulated by a motion detector, a light relay, or a timer, the receiver/regulator unit may be designed as a intermediate part with attachment to a light bulb

and a socket, for the remote control unit may be arranged to control, through simple manipulation, groups consisting of several receiver, control units, possibly with individual current levels.

CLAIMS

1. A method for wireless remote control of at least one electronic equipment, which is connected in an electrical circuit fed from an electricity distribution network, in a system including:

- at least one receiver/regulator unit connected in the same electrical circuit as the electrical equipment,
- at least one remote control unit for transmission of information by means of radiating electromagnetic signals, which include at least a digital signal component to be received by the receiver/regulator unit,

said method, in performing remote control, comprising the steps of:

- transmitting, e.g., in accordance with to an operator's actions, by means of said remote control unit information including at least an identity code,
- receiving in said receiver/regulator unit the transmitted information,
- sensing in said receiver/regulator unit the received information and filtering said information for suppressing possible disturbances,
- checking in said receiver/regulator unit whether or not the identity code included in the filtered information corresponds to an identity code assigned to this receiver/regulator unit, and
- in case the identity code included in the filtered information corresponds to the identity code assigned to said receiver/regulator unit, altering in said receiver/regulator unit a current in the electrical circuit in which said receiver/regulator unit is connected,

said method being c h a r a c t e r i z e d b y the step of:

- assigning, prior to performing remote control, said receiver/regulator unit a unique identity code selected from a predetermined group of a very large number of possible identity codes.

2. A method according to claim 1, wherein the received information is represented in said receiver/regulator unit by a signal being a digital bit sequence, said method being c h a r a c t e r i z e d i n that said step of sensing and filtering the received signal comprises the steps of:

- amplifying the signal,
- filtering the amplified signal according to a majority method known per se, in which several sensings are performed for every bit in the bit sequence, and
- regulating the amplification of the signal, before the filtering, towards giving, in the filtering, equal absolute values for a mean value of sensings at high levels in the bit sequence and a mean value of sensings at low levels in the bit sequence, by which secure reception is obtained.

3. A method according to claim 1 or 2, c h a r a c t e r i z e d i n that said unique identity code is a binary code of at least sixteen positions.

4. A method according to any one of claims 1-3, c h a r a c t e r i z e d b y

- including also an instruction in the information which is transmitted by means of the remote control unit and which contains an identity code, and
- altering the current in the electrical circuit, in which the receiver/regulator unit is connected, by means of the receiver/regulator unit, in case of correspondence between the identity code assigned to this receiver/regulator unit and the identity code included in the filtered information, in a way depending on the instruction included in the filtered information.

5. A method according to any one of claims 1-4, c h a r a c t e r i z e d b y the step of

- assigning in advance to more than one receiver/regulator unit a group code intended for dynamic (changeable) storage in these receiver/control units, said group code corre-

sponding in its form to the identity code, and subsequently, when performing remote control, the steps of

- sending by means of the remote control unit information including at least one group code,
- receiving in the receiver/regulator units the transmitted information,
- sensing and filtering in the receiver/regulator unit for suppressing of possible disturbances the received information,
- checking in the receiver/regulator unit whether the group code in this receiver/regulator unit corresponds to the group code included in the filtered information,
- altering in the receiver/regulator unit, the current in the electrical circuit, in which the receiver/regulator unit is connected, in case of correspondence between the group code stored in this receiver/regulator unit and the group code included in the filtered information.

6. A system, particularly for performing a method according to any of the preceding claims, for wireless remote control of at least one electrical equipment, which is connected in an electrical circuit fed from an electricity distribution network, said system comprising

- at least one receiver/regulator unit connected in the electrical circuit, in which the electrical equipment is connected,
- at least one remote control unit for transmitting information by means of electromagnetic signals to be received by the receiver/regulator unit, wherein
- each receiver/regulator unit comprises a receiver means for reception of signals transmitted from the remote control unit, a memory means for storing of information, and a regulation means for regulating a current in the electrical circuit, in which the electrical equipment is connected,
- information, in the form of an identity code, is stored in the memory means in each of the receiver/regulator units,
- the remote control unit is operable to transmit signals containing information carrying signal blocks, each

containing at least a first section indicating at least one of the identity codes stored in the memory means of the receiver/regulator units,

- each receiver/regulator unit comprises a signal processing means arranged partly to sense the received signals and check for correspondence between the identity code transmitted from the remote control unit and the identity code stored in the memory means, partly to control, in the case of correspondence, the regulating means to alter the current in the electrical circuit to which the electrical equipment is connected,
- it is further possible to manipulate the remote control unit to transmit signals containing information carrying signal blocks, each of which also contains at least one second section indicating at least one instruction,
- at least one signal processing means, which is incorporated in the receiver/regulator unit, is further arranged partly to interpret said instruction, partly to control the regulating means to alter the current, depending on the instruction, in the electrical circuit, to which the electrical equipment is connected,

c h a r a c t e r i z e d b y

- the identity code stored in the memory means in each of the receiver/regulator units, being unique for its respective receiver/regulator unit,
- signal processing means of the receiver control/units being arranged, in order to suppress possible disturbances, to filter the received information as well as to adapt an amplification of a received signal, which contains said information, for equally secure reception of high and low levels in the received signal.

7. A system according to claim 6, wherein radio frequency electromagnetic signals containing said information are received, c h a r a c t e r i z e d i n that a conductor included in said electrical circuit is used as a receiving antenna.

8. A device in a system according to claim 6, constituting said remote control unit.

9. A device included in a system according to claims 6 or 7, constituting said receiver/regulator unit.

10. A method for detection, in particular for carrying out the method according to any of claims 1-5, for secure detection of digital signals with high levels and low levels and preferably having a great information content, and having non-ideal signal characteristics as a result of, for example, disturbances or distortion, c h a r a c t e r i z e d b y a combination of partly a method known per se to amplify signals with amplification control, partly a majority method known per se applied to the amplified signals, wherein mean values of majority values of sensed high and low levels within a predetermined time period of the signals, said majority values being calculated in carrying out majority method, are used to control the amplification striving to obtain equally great absolute values of said mean values.

Fig.1

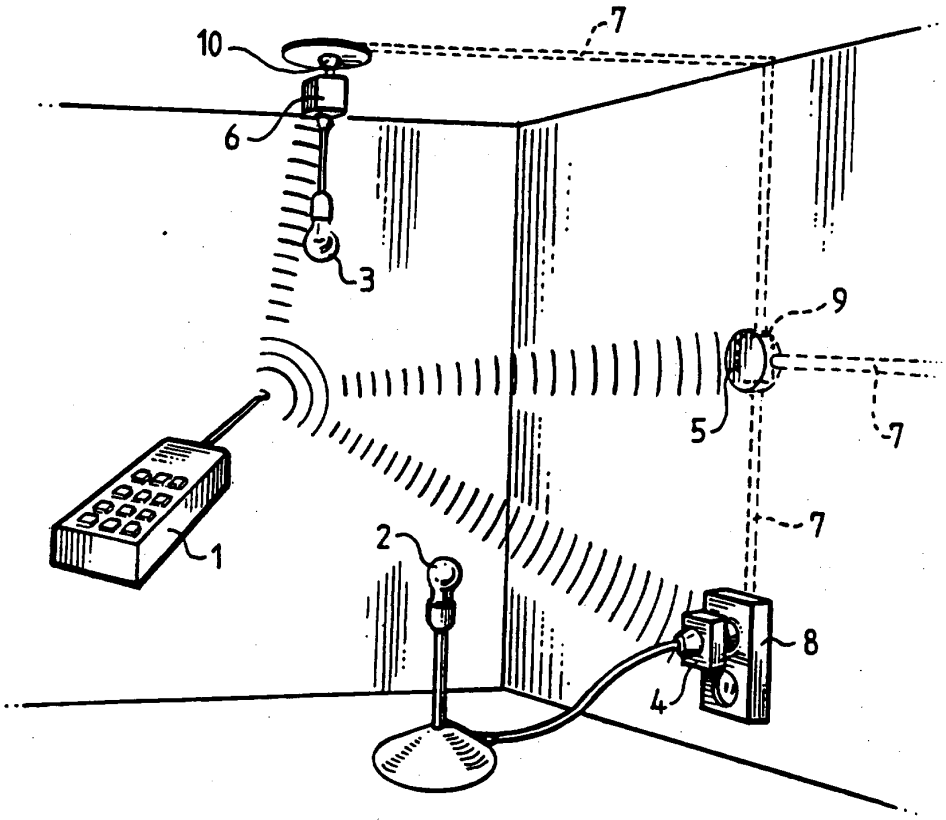
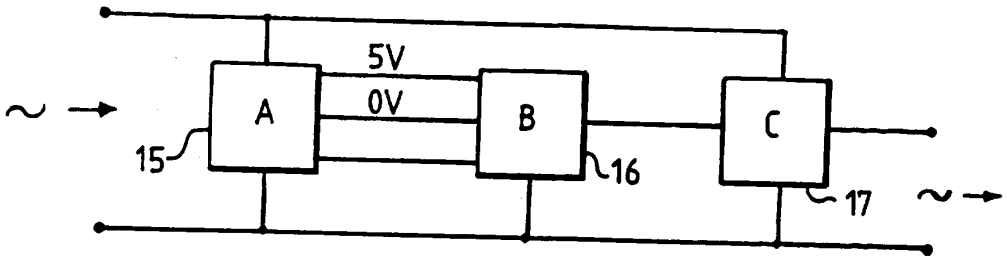


Fig.2



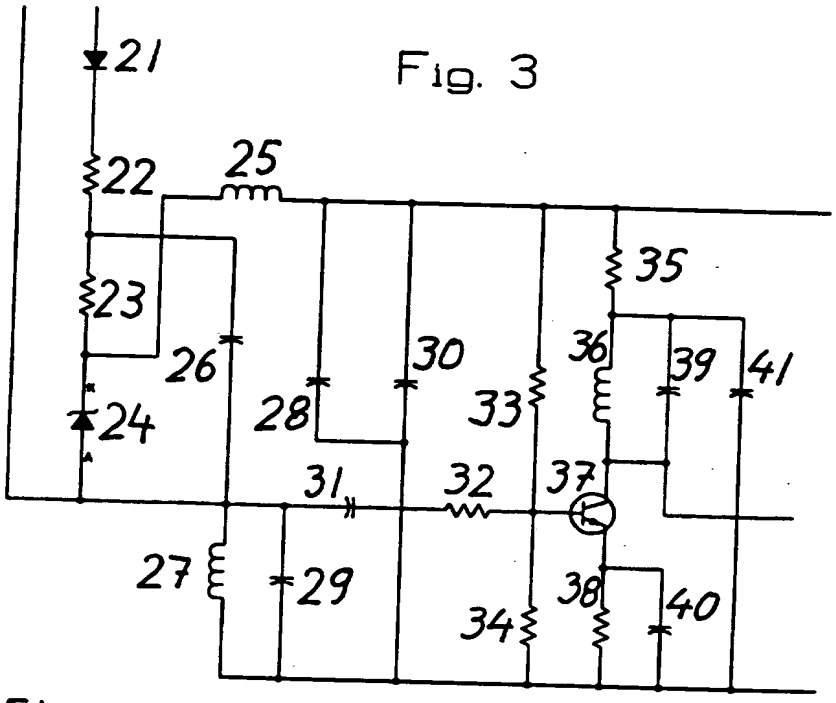


Fig. 3

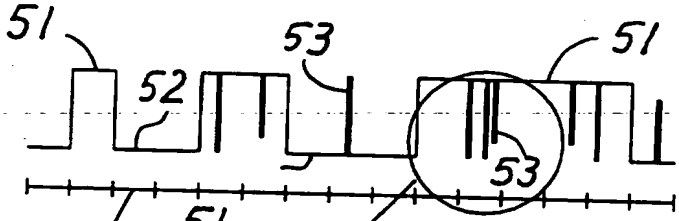


Fig. 4 A

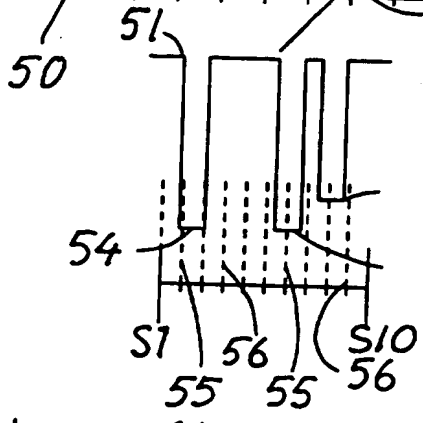


Fig. 4 B

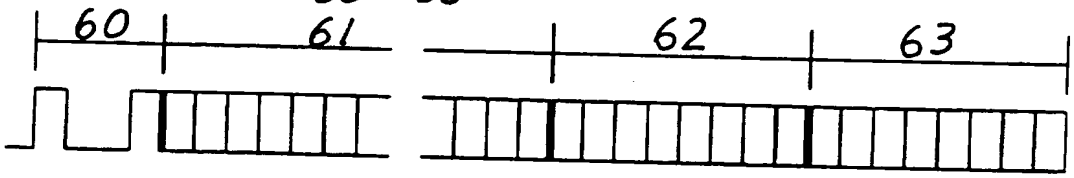


Fig. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 95/00970

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 9/00, H04L 27/06
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: G08C, H04L, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9222048 A1 (FELLER AG), 10 December 1992 (10.12.92), page 5, line 17 - page 6, line 12, figures 3,8	1,3-6,8-9
Y	page 5, line 17 - page 6, line 12, figures 3,8	2,7,10
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Y	Erik T. Glas, "Elektroniska tillämpningar", 1961, P.A. NORSTEDT & SÖNERS FÖRLAG, (Stockholm), page 108 - page 115, especially page 115 line 2 - line 3	7
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Y	GB 2253547 A (SHAYE COMMUNICATIONS LIMITED), 9 Sept 1992 (09.09.92), page 12, line 8 - line 13; page 2, line 30 - page 3, line 4, figure 6, abstract	2,10
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
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"B" erlier document but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 November 1995	25.11.95
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Roland Landström Telephone No. +46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 95/00970

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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X	US 4935736 A (CHARLES MEIERDIERCK), 19 June 1990 (19.06.90), column 2, line 50 - column 26, line 26, abstract	1,3-6,8-9
Y	column 2, line 50 - column 26, line 26, abstract	2,7,10
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X	US 5252966 A (GEORGE LAMBROPOULOS ET AL), 12 October 1993 (12.10.93), column 12, line 13 - line 40, figures 1,1B, abstract	1,3-6,8-9
Y	column 12, line 13 - line 40, figures 1,1B, abstract	2,7,10
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X	US 4596985 A (WILHELM BONGARD ET AL), 24 June 1986 (24.06.86), column 1, line 1 - column 5, line 37, figure 1, abstract	1,3-6,8-9
Y	column 1, line 1 - column 5, line 37, figure 1, abstract	2,7,10
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INTERNATIONAL SEARCH REPORT

Information on patent family members

02/10/95

International application No.
PCT/SE 95/00970

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		SE-B,C- 466510	24/02/92
		SE-A- 8306489	28/05/84
		SE-A- 8903745	09/05/91

Fig.1

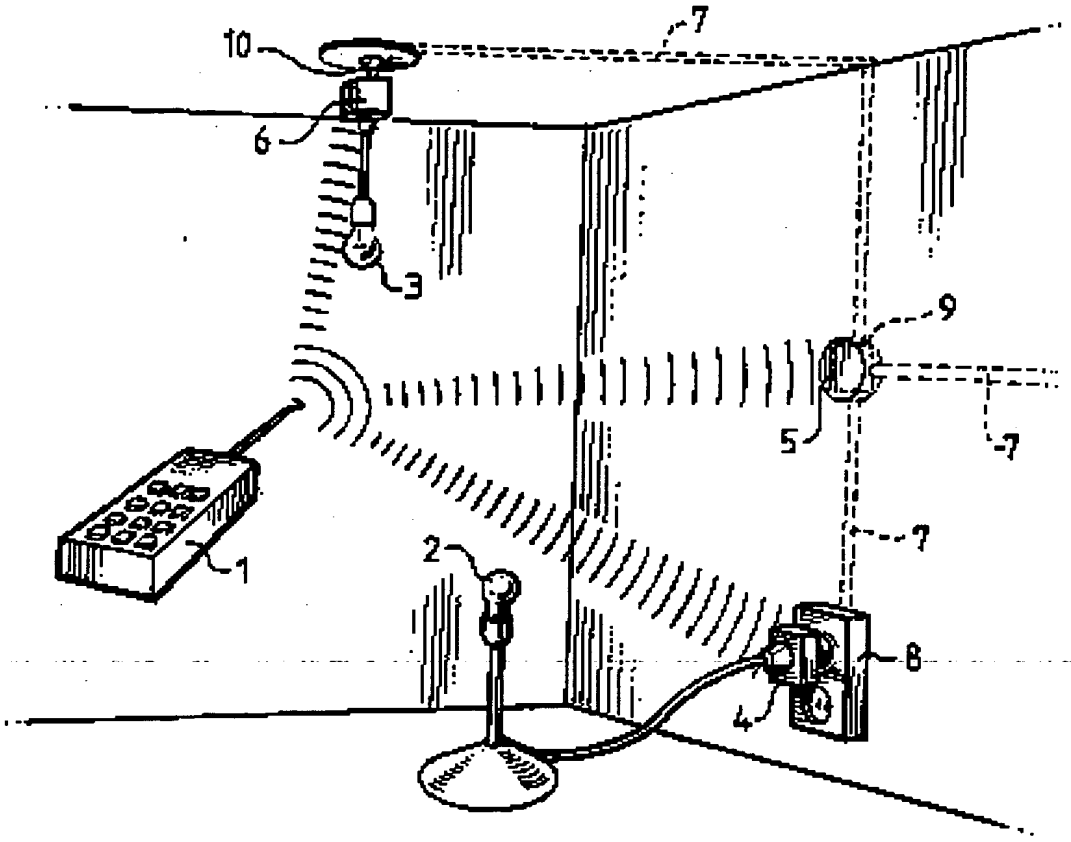
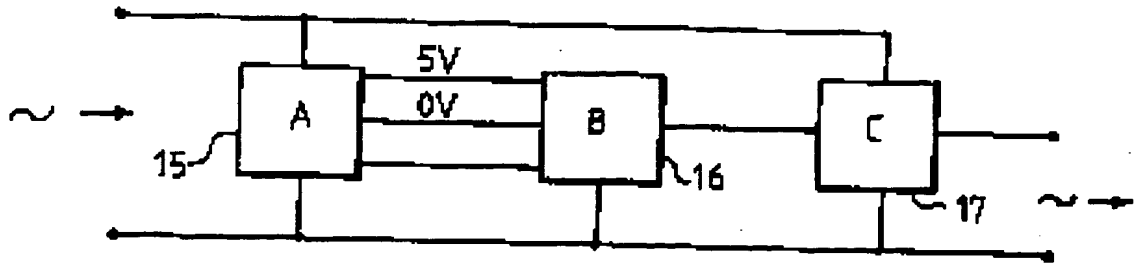


Fig.2



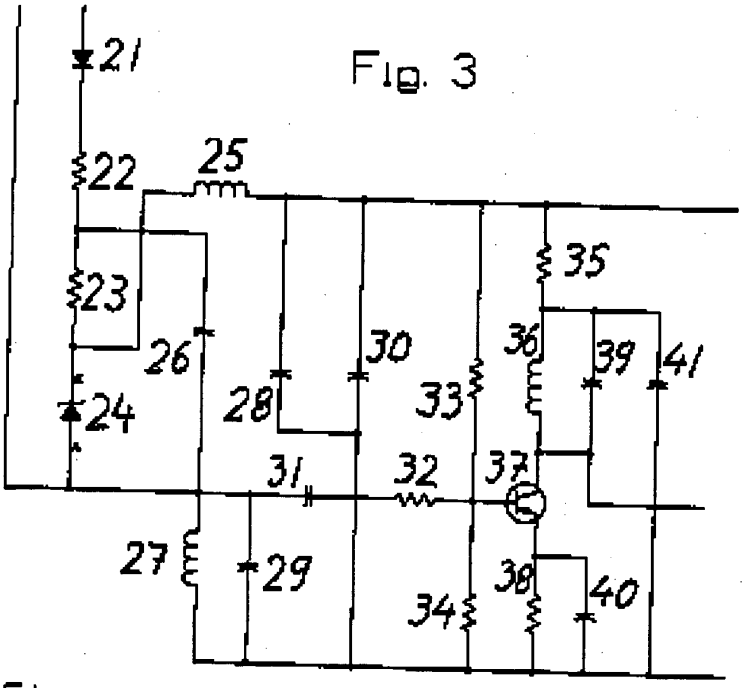


Fig. 3

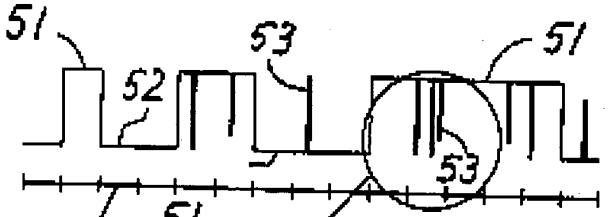


Fig. 4 A

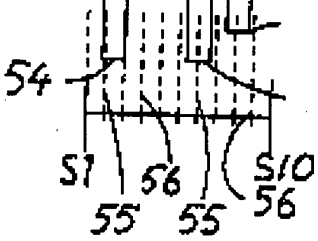


Fig. 4 B

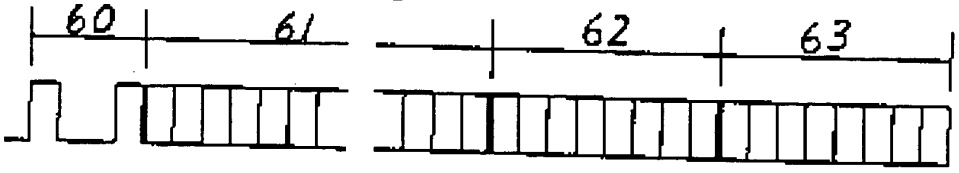


Fig. 5